The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific
and Cultural Organization

International Atomic
Energy Agency

World Year of Physics 2005

Workshop on "Physics for Renewable Energy"
October 17 - 29, 2005

301/1679-34

"Strengthening Planning Capabilities for Sustainable Development"

A. McDonald
IAEA
Vienna, Austria

Strengthening Planning Capabilities for Sustainable Development

ICTP, Trieste, Italy • 28 October 2005

Alan McDonald

Department of Nuclear Energy

IAEA

International Atomic Energy Agency

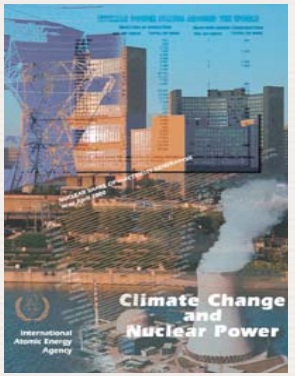
Planning & analysis tools

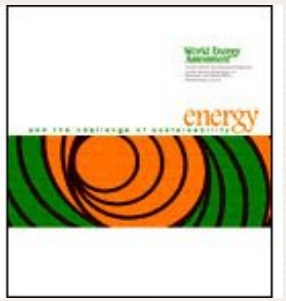
- The IAEA builds energy analysis and planning capabilities mainly in developing countries
  - 231 trainees in 2004

IAEA

Keeping the nuclear option open

- Helps keep the nuclear power option open by being in the midst of important international negotiations and studies that set the stage on which nuclear power competes
  - IPCC's Fourth Assessment Report on Mitigating Climate Change
  - IPCC special reports on emissions scenarios and carbon capture





IAEA

Energy modelling & capacity building

- Develop and transfer planning models tailored to developing country circumstances
- Transfer the latest data on technologies, resources and economics
- Train local experts
- Jointly analyze national options and interpret results
- Help establish continuing local planning expertise
- *Studies done by countries*
- Also some studies done by Agency

IAEA

IAEA energy analysis tools

- Model for the Analysis of Energy Demand
- Wien Automatic System Planning Package
- Energy and Power Evaluation Programme
- Model for Energy Supply System Alternatives and their General Environmental impacts
- Financial Analysis of Electric Sector Expansion Plans
- Simplified Approach for Estimating Impacts of Electricity Generation
- Energy Indicators for Sustainable Development

IAEA

MAED – energy demand

INPUT

- Energy sector data (energy balance)
- Scenario assumptions
  - Socio-economic
  - Technological
- Substitutable energy uses
- Process efficiencies
- Hourly load characteristics

OUTPUT

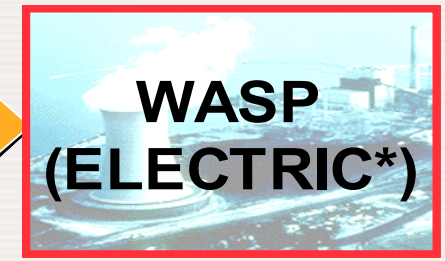
- Final energy demand
- Electricity demand
- Hourly electric load
- Load duration curves (ELECTRIC)

IAEA

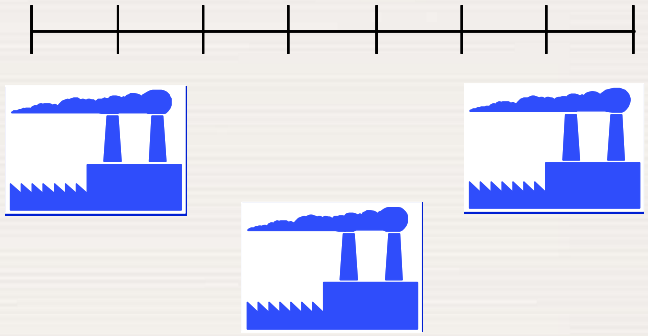
WASP – electricity system analysis

INPUT

- Load forecast
- Existing system
- Candidates
- Constraints
  - Reliability
  - Implementation
  - Fuel
  - *Generation (W-IV)*
  - *Emissions (W-IV)*



OUTPUT



- Capacity expansion schedule
- Generation mix
- Costs
- Fuel use
- *Emissions (WASP-IV)*

IAEA

MESSAGE – energy system analysis

INPUT

- Energy system description
- Energy demand projections
- Tech. & physical constraints
- Environmental regulations
- Technology innovations
- Market players

OUTPUT

Optimal energy strategies

Energy trade & market prices

Efficacy of Envi. Regulations

Effectiveness of DSM, Taxes, etc.

IAEA

FINPLAN – financial analysis

INPUT

- Investment programme (<= capacity additions) & operating expenses
- Economic and fiscal parameters (inflation, escalation, exchange rates, taxes)
- Financial parameters (credits, bonds…)

OUTPUT

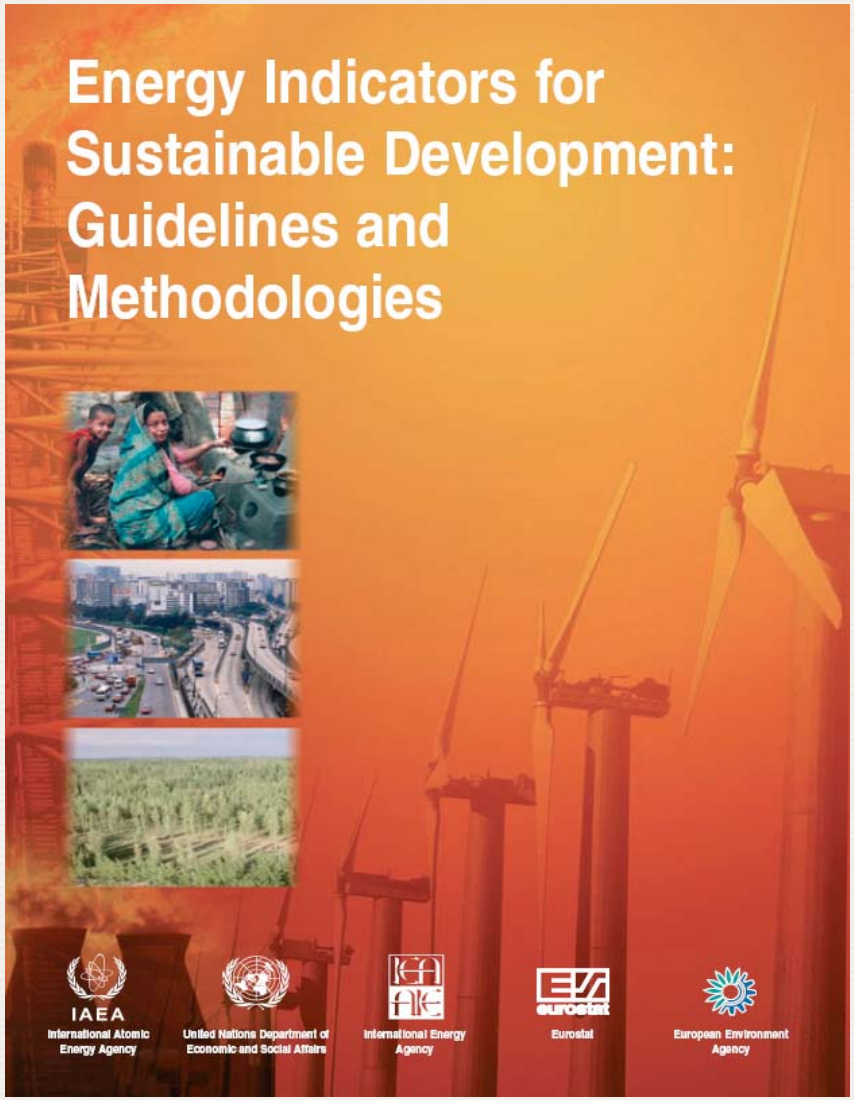
For each year:

- Cash flows
- Balance Sheet, Statement of Sources, Applications of Funds
- Financial Ratios:
  - Working Capital Ratio
  - Leverage ratio
  - Debt Repayment Ratio
  - …
  - Global Ratio

IAEA

WSSD partnership – indicators

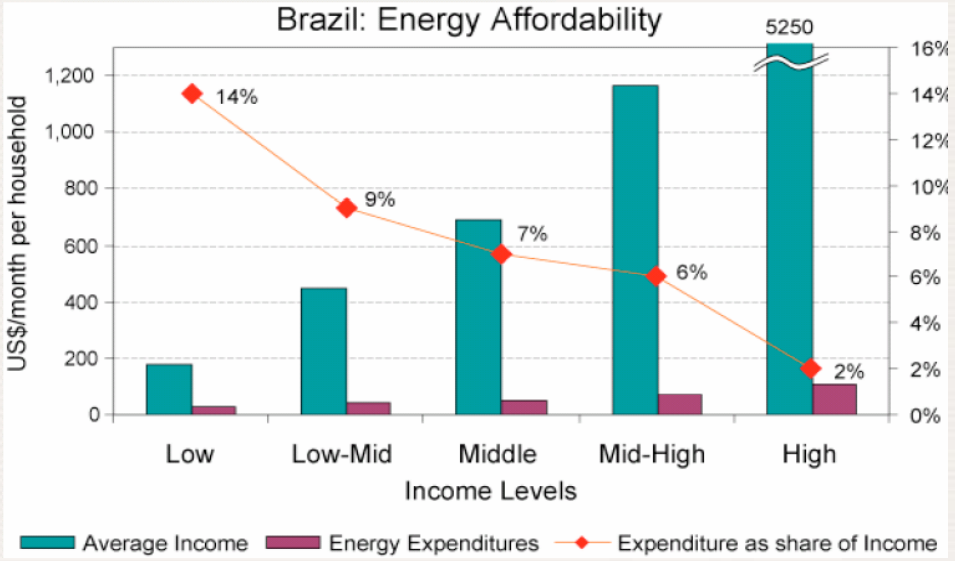
- Brazil, Cuba, Lithuania, Mexico, Russia, Slovakia
- EEA, Eurostat, IEA, OLADE, DESA, IAEA
- inter-agency report
  - methodology sheets, guidelines, procedures
- CSD-14/15 in 2006/2007



IAEA

Indicators: EISD, innovation, CSR

- Integration of EISD into model package
  - RAS project – 14 countries MESSAGE/EISD
  - Critical analysis
  - with APEC/IEA
- CSR
  - Public acceptance



- Innovation – preconditions and products
  - Multi-country case studies

IAEA

Example training course

NATIONAL TRAINING COURSE ON ENERGY AND ELECTRICITY DEMAND ANALYSIS AND PROJECTIONS USING IAEA'S MODEL MAED
Baku, Azerbaijan, 4-15 July 2005

DAY / TIME	MONDAY 4 July	TUESDAY 5 July	WEDNESDAY 6 July	THURSDAY 7 July	FRIDAY 8 July
900-1030	Meeting with national counterpart COURSE OPENING	Lecture Mathematical Equations in MAED-d	Lecture MAED-d Base year reconstruction	Work Session Initial Information. Industry	Lecture / Work Session Preparation of Input Data for MAED-d
1030-1045		Coffee Break	Coffee Break	Coffee Break	Coffee Break
1045-1215	Presentation Overview of IAEA Tools for Sustainable Energy Development	Lecture Mathematical Equations in MAED-d	Lecture / Work Session Input data preparation tool	Work Session Initial Information. Industry	Work Session Reconstruction of Base Year Energy Demand
1215-1315	Lunch	Lunch	Lunch	Lunch	Lunch
1315-1445	Lecture Overview of MAED	Presentation MAED application for national study in Croatia	Work Session Initial Information. Macro Economics and Demography	Work Session Initial Information. Transportation	Work Session Reconstruction of Base Year Energy Demand
1445-1500	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
1500-1630	Lecture MAED Application for Energy Demand Projection	Lecture / Work Session MAED Excel Computer Familiarization	Work Session Initial Information. Energy balances	Work Session Initial Information. Household, Service	Work Session Preparation of participants presentation

IAEA

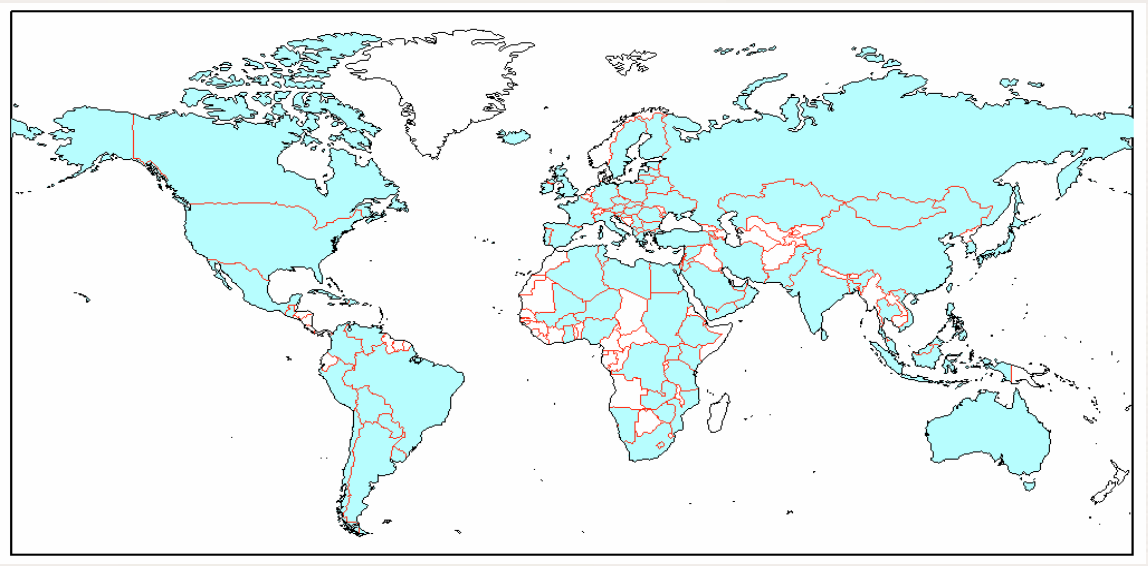
Example training course – 2nd week

NATIONAL TRAINING COURSE ON ENERGY AND ELECTRICITY DEMAND ANALYSIS AND PROJECTIONS USING IAEA'S MODEL MAED
Baku, Azerbaijan, 4-15 July 2005

DAY / TIME	MONDAY 11 July	TUESDAY 12 July	WEDNESDAY 13 July	THURSDAY 14 July	FRIDAY 15 July
900-1030	Lecture MAED-el Base year reconstruction	Lecture MAED-el EXCEL Computer familiarization	Lecture Tools for Scenario Development	Lecture Analysis of MAED Scenario Development Results	Participants presentation Case study assumptions and preliminary results
1030-1045	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
1045-1215	Work Session MEAD-el Input data preparation Total hourly load, references, clients, calendar	Work Session Reconstruction of Base year Electrical Load Curve	Work Session Scenario Development Macroeconomy, Demography Other parameters	Work Session Analysis of Scenario Results and improvement of reference scenario. Sensitivity analysis	Participants presentation Case study assumptions and preliminary results
1215-1315	Lunch	Lunch	Lunch	Lunch	Lunch
1315-1445	Work Session MEAD-el Input data preparation Modulating coefficients	Lecture Scenario in MAED	Work Session Alternative scenarios. Parameters for sensitivity analysis	Work Session Preparation of participants presentation	Presentation MAED study success COURSE CLOSING
1445-1500	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
1500-1630	Work Session MEAD-el Input data preparation Modulating coefficients	Work Session Scenario Development Verbal description	Q & A Session	Work Session Preparation of participants presentation	Recommendations on follow up activities

IAEA

Dissemination

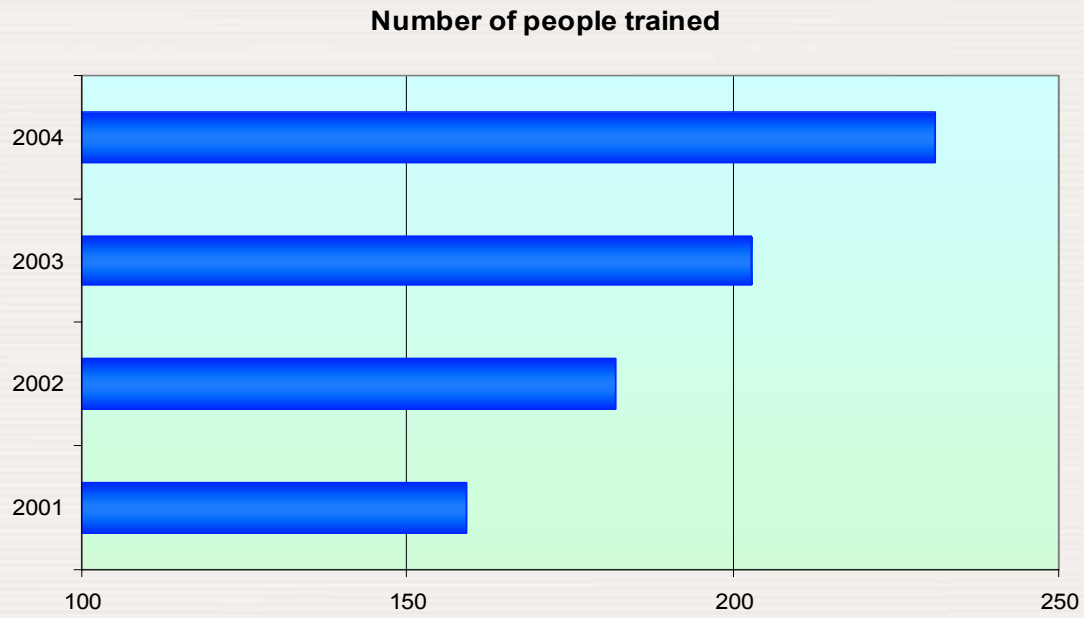


- 102 countries
- Continuing needs
  - new MS, new models, new studies, new trainees

IAEA

Training

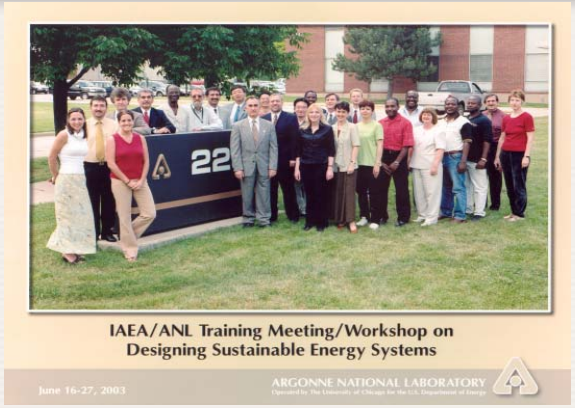
- Growing demand
  - Energy system more complex with modernization
  - Liberalization & privatization
    - public – private divergence
  - Environmental concerns
  - Growing awareness



IAEA

Training

- Regional workshops
  - USA: Argonne National Lab
  - Republic of Korea: KAERI
  - Europe: ICTP
- National & sub-regional
  - Iran, Cuba, Mongolia & west Asia
- ‘Training the trainers’



IAEA

Continuous model improvement

- Annual feedback meeting
  - users, developers, policy makers
- EMCAS
  - behaviour of liberalized electricity markets
- PLEXFIN
  - economics of lifetime extension (with NPES)
- PMAT
  - plant modification assessment tool (with NPES)

IAEA

2006-2007 initiatives

- Distance learning
  - to augment, not replace, teachers
- Tele-support system
  - better manage remote support

IAEA

Country studies

- Studies similar to those for strengthening capabilities building but done by Agency
  - motivated by
    - speed
    - expertise
    - specific topics
  - can be done in parallel with strengthening capabilities

IAEA

Energy analysis & planning

- Recently completed country studies
  - Bulgaria, China, Haiti, India, Indonesia, Rep. of Korea, Lithuania, Mongolia, Nigeria, Pakistan, Philippines, Sri Lanka, Vietnam
- 2005 starts
  - Regional projects in Europe (3 countries) and Asia (13 countries)
  - Azerbaijan, Columbia, Ghana, Guatemala & Nicaragua

IAEA

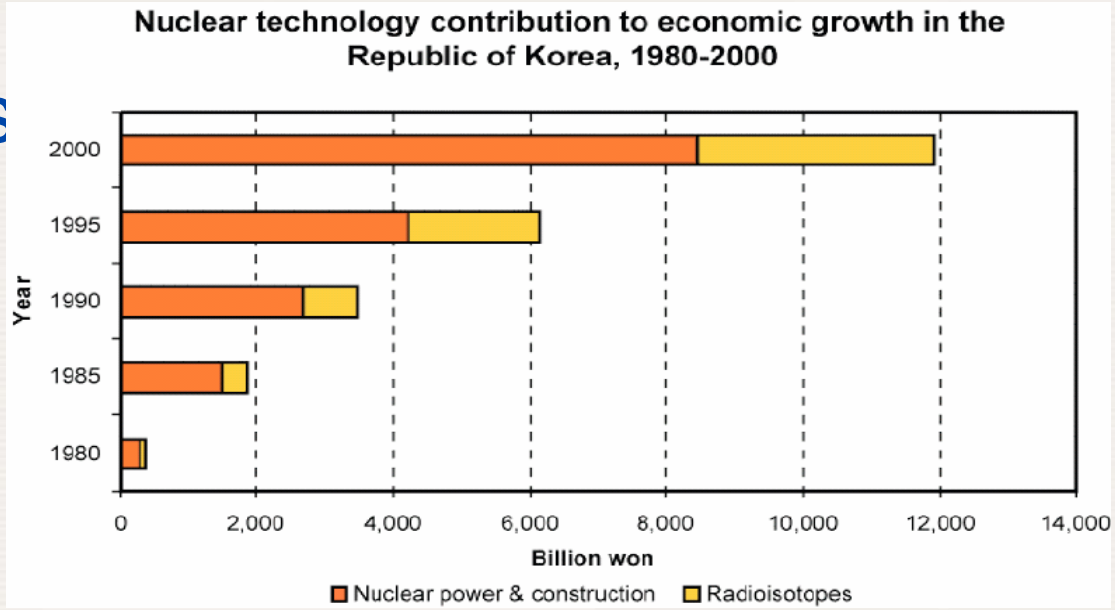
Regional studies

- Regional studies
  - Grid integration in Europe and in the Middle East
  - Regionalisation of aspects of the nuclear fuel cycle
  - Regional Africa
  - Regional Asia

IAEA

Country studies

- Contribution of nuclear technologies to regional development and environment in Korea
- Sustainable energy development in Romania



IAEA

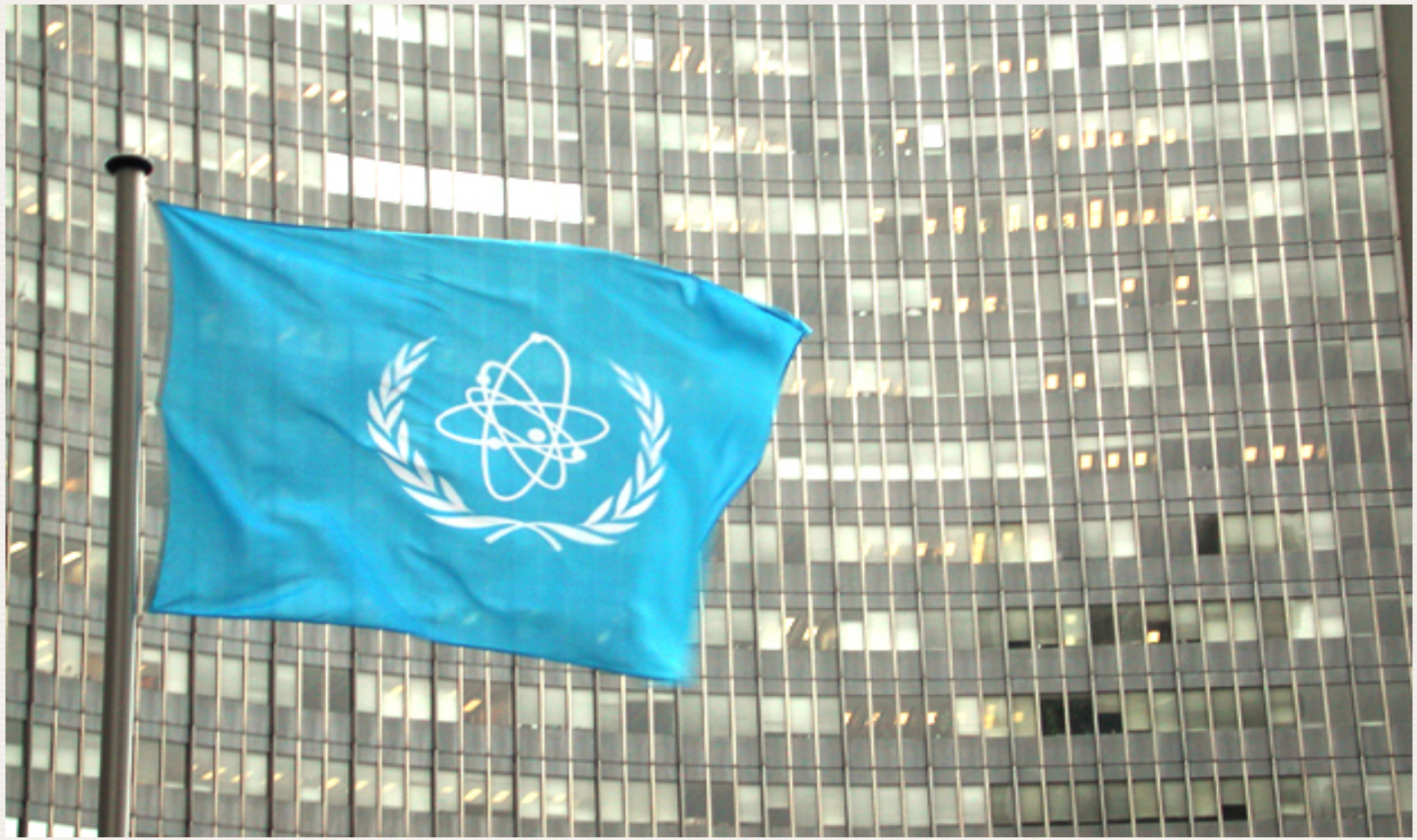
WSSD partnership – country profiles

- Country profiles
  - Phase 1: demonstration in Brazil (Brazil, ECLAC, OLADE)
  - Phase 2: “replication and dissemination”
  - Cuba, South Africa & Romania

- UN-Energy, post-WSSD, joint renewables study

IAEA

IAEA: Strengthening energy planning



IAEA

…atoms for peace.